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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/773,183	02/09/2004	Kia Silverbrook	MTB22US	8428

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SILVERBROOK RESEARCH PTY LTD
393 DARLING STREET
BALMAIN, 2041
AUSTRALIA

EXAMINER	
FIDLER, SHELBY LEE	
ART UNIT	**PAPER NUMBER**
2861	

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/06/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary	Application No.	Applicant(s)	
	10/773,183	SILVERBROOK, KIA	
	Examiner	Art Unit	
	Shelby Fidler	2861	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 January 2007*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-6,8,10-22,24,25,27,29-44 and 46-54* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6,8,10-22,24,25,27,29-44 and 46-54* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *12/7/2006*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-2, 5, 11, 15, 17-20, 24, 30, 34, 36-39, 42, 47, 51, and 53-54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubby (US 5851412) in view of DeMoor et al.

Regarding claims 1, 17, 19, 36, 38, and 53:

Kubby discloses an ink jet printhead comprising:

a plurality of nozzles (ejector 32; col. 3, lines 31-38), each nozzle having a respective bubble forming chamber (cavity 16);

at least one heater element (e.g. doped region 20) disposed in each of the bubble forming chambers respectively (Figs. 1 and 5), the heater element being configured for thermal contact with a bubble forming liquid (col. 4, lines 19-26);

drive circuitry (conductors 24) corresponding to each of the nozzles (Fig. 1) for controlling the operation of the heater element (col. 4, lines 16-19) such that

heating a mass of solid material incorporated in the heater element (20) to a temperature above the boiling point of the bubble forming liquid forms a gas bubble that causes the ejection of a drop of an ejectable liquid through the nozzle corresponding to that heater element (col. 5, lines 13-19); wherein,

part of the drive circuitry (24) is disposed on one side of the bubble forming chamber (left side of line 2-2 in Fig. 1), and part of the drive circuitry is formed on the opposing side of the bubble forming chamber (right side of line 2-2 in Fig. 1); and

supplying the nozzle with a replacement volume of the ejectable liquid equivalent to the ejected drop (obvious to col. 1, lines 24-37).

Kubby does not expressly disclose that the heater element is in the form of a cantilever beam, or heating a mass of solid material incorporated in the heater element of less than 2 nanograms.

However, Kubby does disclose that the suspended portion may be suspended by any number of legs (col. 4, lines 5-10 and Fig. 1); and

DeMoor et al. disclose a heater element of less than 2 nanograms (page 285, Fabrication: Ti thickness = 5nm; TiN thickness = 30nm; heater width = 2000μm; heater width = 0.4μm. Therefore, the volume of Ti within the heater is $4*10^{-12}$ cm^3, and the volume of TiN within the heater is $2.4*10^{-11}$ cm^3. Using the known densities of Ti = 4.54 g/cm^3 and TiN = 5.22 g/cm^3, the heater element has an entire mass of 0.14344 ng).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize two legs to create a cantilever beam out of the suspended portion Kubby's invention. One motivation for doing so, as taught by Kubby, is to provide a heater element with an increased overall heat-transference efficiency since both sides can dissipate heat (col. 5, lines 33-48). It would have been further obvious to a person of ordinary skill in the art to utilize a heater element of less than 10 nanograms. The motivation for doing so, as taught by DeMoor et al., is to provide a heater element that shows excellent resistivity uniformity and a low TCR value (page 293, Conclusions).

Regarding claims 2, 20, and 39:

Kubby also discloses that the heater elements (20) and bubble forming chamber (16) are symmetrical about a longitudinal plane (Fig. 1).

Regarding claims 5, 24, and 42:

Kubby also discloses that the bubble forming liquid and the ejectable liquid are of a common body of liquid (col. 5, lines 11-21 and Figs. 1 and 5).

Regarding claims 11, 30, and 47:

Kubby also discloses that each heater element (20, 22) has two opposite sides (the side of 20 and the side of 22, respectively) and is configured such that the gas bubble formed by the heater element is formed at both sides of the heater element (col. 5, lines 13-21).

Regarding claims 15, 34, and 51:

Kubby also discloses a plurality of the bubble forming chambers (16), each corresponding to a respective nozzle (obvious to col. 3, lines 28-38), and a plurality of the heater elements (20, 22) being disposed within each bubble forming chamber (Fig. 1), the heater elements within each bubble forming chamber being formed on different respective layers to one another (col. 4, line 66 – col. 5, line 10 and Fig. 4).

Regarding claims 18, 37, and 54:

Kubby also discloses that each heater element is covered by a conformal protective coating (protective tantalum layers; col. 4, lines 35-36), the coating of each heater element having been applied substantially to all sides of the heater element simultaneously such that the coating is seamless (Figs. 1 and 3).

Claims 3-4, 12, 21-22, 31, 40-41, and 48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubby as modified by DeMoor et al., as applied to claim 1 above, and further in view of Campbell et al. (US 4870433).

Regarding claims 3, 21, and 40:

Kubby as modified by DeMoor et al. disclose all claimed limitations except that the bubble forming chamber has a circular cross section wherein the heater element has at least one arcuate section that is concentric with the longitudinal axis of the bubble forming chamber, such that during use, the arcuate section forms a disc-shaped bubble with a point of collapse substantially on the central axis of the bubble forming chamber.

However, Campbell et al. disclose a bubble forming chamber (21) that has a circular cross section (Fig. 1) wherein a heater element (12) has at least one arcuate section (elongated portions 31) that is concentric with the longitudinal axis of the bubble forming chamber (Fig. 3) such that during use, the arcuate section forms a disc-shaped bubble (bubble 22; col. 3, lines 50-58) with a point of collapse substantially on the central axis of the bubble forming chamber (col. 3, lines 60-64).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a bubble forming chamber configuration and heater element design such as those taught by Campbell et al. into the invention of Kubby as modified by DeMoor et al. The motivation for doing so, as taught by Campbell et al., is to provide a heater element geometry that forms a bubble with high pumping efficiency, and to avoid cavitational damage to the heater (col. 3, lines 14-19).

Regarding claims 4, 22, and 41:

Kubby as modified by DeMoor et al. disclose all claimed limitations except that the gas bubble encircles at least some of the heater element.

However, Campbell et al. disclose forming a gas bubble (bubble 22) that encircles some of a heater element (Fig. 2).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a heater element design such as that taught by Campbell et al. into the invention of Kubby as modified by DeMoor et al. The motivation for doing so, as taught by Campbell et al., is to provide a heater element geometry that forms a bubble with high pumping efficiency, and to avoid cavitational damage to the heater (col. 3, lines 14-19).

Regarding claims 12, 31, and 48:

Kubby as modified by DeMoor et al. disclose all claimed limitations except that the bubble is collapsible and has a point of collapse, and wherein each heater element is configured such that the point of collapse is spaced from any solid surface of the heater elements.

However, Campbell et al. disclose that a bubble (22) that is collapsible and has a point of collapse, and wherein each heater element (12) is configured such that the point of collapse is spaced from any solid surface of the heater elements (col. 3, lines 60-64).

Therefore, at the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a heater element design such as that taught by Campbell et al. into the invention of Kubby as modified by DeMoor et al. The motivation for doing so, as taught by Campbell et al., is to provide a heater element geometry that forms a bubble with high pumping efficiency, and to avoid cavitational damage to the heater (col. 3, lines 14-19).

Claim 6, 8, 10, 13-14, 25, 27, 29, 32-33, 43-44, 46, and 49-50 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubby as modified by DeMoor, as applied to claim 1 above, and further in view of Silverbrook (US 6019457).

Regarding claims 6, 25, and 43:

Kubby as modified by DeMoor disclose all claimed limitations except that the printhead is configured as a pagewidth printhead.

However, Silverbrook discloses a pagewidth printhead (head 200) configured to print on a page (col. 6, lines 7-12).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a pagewidth printhead into the invention of Kubby as modified by DeMoor et al. The motivation for doing so, as taught by Silverbrook, is to be able to print on the width of an A4 page (col. 6, lines 7-12).

Regarding claims 8, 27, and 44:

Kubby as modified by DeMoor disclose all claimed limitations except that the heater elements are configured such that an actuation of less than 500 nJ is required to be applied to the heater elements so as to form the bubble in the bubble forming liquid to cause the ejection of the drop.

However, Silverbrook discloses heater elements (heaters 120; Fig. 10) that are configured such that an actuation energy of less than 500 nJ is required to heat the heater element sufficiently to form the bubble in the bubble forming liquid, thereby causing an ejection of the drop (200 nJ; col. 19, lines 8-9).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize heater elements that require less than 500 nJ to heat the heater element to eject a

drop into the invention of Kubby as modified by DeMoor et al. The motivation for doing so, as taught by Silverbrook, is to allow power dissipation to be reduced without affecting print speed (col. 19, lines 9-10).

Regarding claims 10, 29, and 46:

Kubby as modified by DeMoor et al. disclose all claimed limitations except that the substrate surface has an areal density of nozzles exceeding 10,000 nozzles per square centimeter of substrate surface.

However, Silverbrook discloses a substrate surface wherein the areal density of the nozzles relative to the substrate surface exceeds 10,000 nozzles per square centimeter of substrate surface (using the reference measurement of Figure 43 and counting the individual nozzles disclosed in the "part of cyan" section of Figure 43, calculations show that the density exceeds 10,000 per square centimeter: $\frac{20 nozzles}{0.0016384 cm^2} = 12207 \frac{nozzles}{cm^2}$).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a printhead substrate surface with a nozzle density of 10,000 nozzles per square centimeter into the invention of Kubby as modified by DeMoor et al. The motivation for doing so, as taught by Silverbrook, is to provide four nozzles per pixel which would give up to 16 drops per pixel (co. 16, lines 60-62).

Regarding claims 13, 32, and 50:

Kubby as modified by DeMoor et al. disclose all claimed limitations except a structure, wherein the nozzles are incorporated on the structure.

However, Silverbrook discloses a structure (overcoat 142), wherein nozzles are incorporated on the structure (Fig. 11).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize a structure on which the nozzles are incorporated into the invention of Kubby as modified by DeMoor et al. The motivation for doing so, as taught by Silverbrook, is to provide increased levels of protection against the air (col. 9, lines 5-8).

Regarding claims 14, 33, and 49:

Kubby as modified by DeMoor et al. disclose all claimed limitations except a structure that is less than 10 microns thick, the nozzles being incorporated on the structure.

However, Silverbrook discloses a structure (overcoat 142) that is less than 10 microns thick (col. 9, lines 8-10), wherein nozzles are incorporated on the structure (Fig. 11).

Claims 16, 35, and 52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kubby as modified by DeMoor et al., as applied to claim 1 above, and further in view of Anagnostopoulos et al. (US 6502925 B2).

Regarding claims 16, 35, and 52:

Kubby as modified by DeMoor et al. disclose all claimed limitations except that the heater elements are formed of solid material more than 90% of which, by atomic proportion, is constituted by at least one periodic element having an atomic number below 50.

However, Anagnostopoulos et al., discloses heater elements formed of solid material more than 90% of which is constituted by at least one periodic element, having an atomic number below 50 (Ti and TiN, col. 10, lines 31-33).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to utilize heater elements formed of Titanium and Titanium Nitride into the invention of Kubby as modified by DeMoor et al. The motivation for doing so, as taught by Chan (US

5710070), is that the titanium/titanium nitride resistive layer provides good electro-migration performance to sustain high current density at high temperatures (col.3, lines 30-33).

Response to Arguments

Applicant's arguments with respect to claims 1, 19, and 38 have been considered but are moot in view of the new ground(s) of rejection. Please see the above rejection of Kubby in view of DeMoor et al., which teaches a heater element in the form of a cantilever beam.

Communication with the USPTO

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shelby Fidler whose telephone number is (571) 272-8455. The examiner can normally be reached on M-F 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Luu can be reached on (571) 272-7663. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Shelby F. Fidler 3/1/07

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